NOISE ANALYSIS

DYNAMITE CAR WASH

4-D PROPERTIES

2870 N SWAN ROAD, #100

Tucson, Arizona

Noise Expert Project No. 16001

Prepared for
4-D Properties

Prepared by

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1.0 Summary

Noise Expert evaluated the noise radiating from the proposed conveyor system for the Dynamite Car Wash located at 5701 S 12th Ave, Tucson, Arizona.

The predicted noise levels from the conveyor were less than 35 dBA at the property lines. The Tucson City Code limits noise to 70 dBA during daytime hours and 62 dBA during nighttime hours. The predicted noise levels are well below the Tucson City Code.

In addition, the predicted noise levels from the conveyor are well below the existing noise levels at the closest residential properties (55 to 64 dBA).

The addition of the conveyor will not increase the noise radiating from the car wash.

This report presents the information developed by Noise Expert for the noise impact analysis. The information presented in the report includes a description of the proposed operation, measurement results showing the existing environment at noise sensitive properties, an evaluation of the future noise environment expected around the project site, and a discussion about the noise descriptors used in the analysis.

2.0 Overview of the Noise Impact Analysis Procedure

Noise Expert conducted a sound study to determine the noise impacts that will be associated with the proposed conveyor at the existing Dynamite Car Wash. The noise study was conducted in four steps:

1. The current ambient noise levels were measured at noise sensitive receivers (residences) in the vicinity of the existing car wash.

2. Noise levels were measured at an existing car wash with a conveyor installed.

3. Noise levels were predicted at the closest residences to the existing car wash assuming the proposed conveyor was installed.

4. The predicted noise levels at the closest residence to the existing car wash were compared with the existing ambient noise levels and the city of Tucson noise limits.

This report presents the results of the study.

3.0 Overview of the Proposed Facility

The existing Dynamite Car Wash is located at 5701 S 12th Ave in Tucson, Arizona, as shown in Figure 1. It is on the southeast corner of Drexel and 12th Ave.

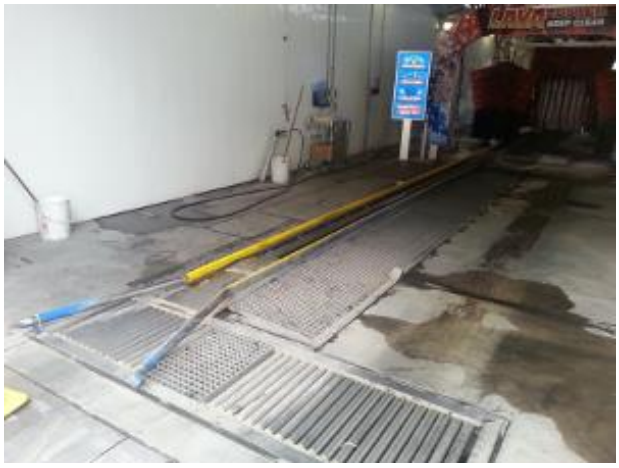
The site is rectangular and measures approximately 180 feet east to west and 170 feet north to south. There are residences adjacent to the car was to the south and east. The closest property line to the south is 50 feet from the automatic car wash entrance. The closest property line to the east is located 21 feet east of the east side of the automatic car wash.

The site is relatively flat. The property to the east is at approximately the same elevation as the car wash. The properties to the south are approximately 3 feet higher than the car wash. There is a barrier on the south and east car wash property lines that is approximately 7 feet high.

The existing Dynamite Car Wash proposes to add a conveyor to their car wash. Currently, the single automatic carwash bay requires that a driver pull into the middle of the bay for the rollers and sprayers to clean the vehicle. The conveyor guides cars into a channel for the driver side wheel. Rollers come up and push the driver's side tire through the stationary rollers and sprayer.

Existing Dynamite Car Wash

Existing Dynamite Car Wash



Conveyor at Quick N Clean Car Wash

Conveyor at Quick N Clean Car Wash

The proposed conveyor bay of Dynamite Car Wash will operate from 7 AM to 8 PM seven days per week. There is an existing 7-foot high wall on the south and east sides of the car wash, between the car wash and the closest residences.

4.0 Noise Impact Criteria

The Dynamite Car Wash is located in the City of Tucson, County of Pima in the State of Arizona.

The Tucson Code (Section 16-31) states that the maximum noise allowed to radiate beyond a property line will be no more than 70 dBA during daytime hours (7 AM to 10 PM) and 62 dBA during nighttime hours (10 PM to 7 AM).

5.0 Sound Level Measurements

Ambient sound levels were measured to get an understanding of the existing noise levels in the vicinity of the site. This helped determine the noise impact of the proposed site.

5.1 Measurement Procedure

Noise levels were measured using a Larson Davis 820 sound level meter that meets the American National Standard Institute (ANSI) requirements for Type 1 sound level meter. The detector of the meter was set for "slow" response. The microphone was located approximately five feet above the ground. The sound level meter was calibrated prior to and after the noise measurements were taken.

Noise was measured during on Saturday morning, April 9, 2016 between 8 and 9 AM.

5.2 Measurement Locations and Results

Existing ambient noise levels were measured at two locations in the vicinity of the site, as shown in Figure 1. The following information describes the measurement locations:

Location1 At the eastern property line approximately 21 feet east of the automatic car wash entrance.

Location 2 At the southern property line approximately 50 feet south of the automatic car wash entrance.

A summary of the noise measurements is shown in Table 1.

Table 1
Measured L_{eq} Noise Level at the Dynamite Car Wash

Activity	Measured L_{eq} Noise Levels (dBA) at the Following Receivers	
	Location 1	Location 2
Traffic on 12th and Drexel	56-60	55-59
Washing in the manual bays	57-61	57-62
Washing in the automatic bay, no conveyor[1]	59-65	60-66

1 does not include dryers

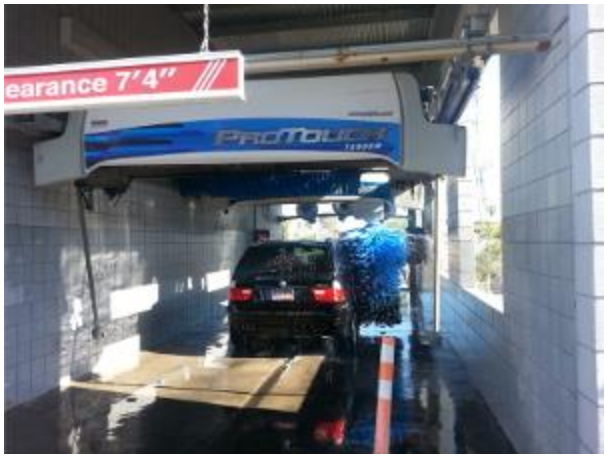
Note that the noise level at the nearest residences will be lower because of the barriers.

5.3 Observations

On Saturday, April 9, 2016 during the measurement period, the weather was mostly sunny and clear. The temperature was approximately 60°F and the average humidity was approximately 64%. It was calm and there was a slight breeze from the southeast during this time.

The primary noise sources were: traffic on S 12th Ave and W Drexel Rd, aircraft, washing activity in the manual (self-serving) bays, and washing in the automatic carwash.

Dynamite Car Wash



Dynamite Automatic Car Wash Bay

During the measurement period, the noise from traffic was 55 to 60 dBA at the measurement locations. Noise from aircraft depended on the type and vicinity. At times an aircraft passing overhead caused noise levels of 65 dBA for a short period of time.

Noise levels at the south and east property lines when a self-serve bay was in use was 57 to 62 dBA. The noise level depended on when the where the activity was occurring in the bay and which bay was in use. The primary noise source was water hitting the vehicles. The manual bay noise added approximately 1 to 3 dBA to the background noise level.

Washing at the automatic car wash caused noise levels of 59 to 66 dBA at the south and east property lines. The noises consisted of electronic beeps, equipment and water spraying.

6.0 Predicted Noise Levels Generated by the Proposed Project

6.1 Noise Prediction Methodology

Established acoustical formulas for outdoor sound propagation were used to predict the noise levels that will radiate from the proposed operations. The calculation accounts for sound attenuation due to distance, atmospheric conditions, barriers and vegetation.

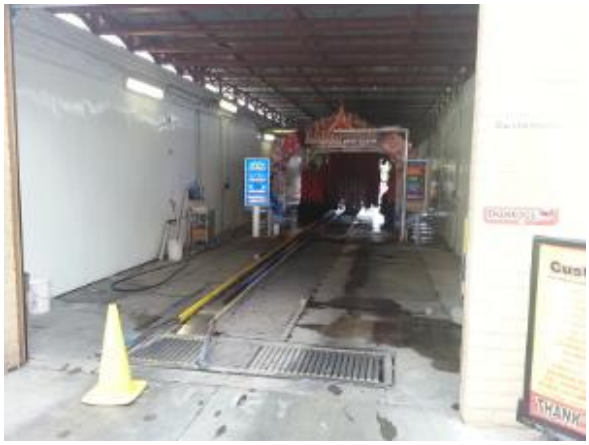
6.2 Reference Noise Levels

Noise from the conveyor system as measured at the Quick N Clean Car Wash located at 2140 N Kolb Road, Tucson, Arizona. Noise measurements were made on Friday, April 8, 2016 from 8 AM to 9 AM.

The conveyor system consists of a chain with rollers that push a vehicle wheel through the wash. There is a metal flap that makes a noise when the rollers first surface (when a vehicle is in position). Our understanding is that the metal flap will not be part of the new conveyor system used at Dynamite Car Wash.

The conveyor system (without the metal flap) is not audible above the background noise at a position 20 feet from the conveyor. The background noise level was 60 to 65 dBA from traffic on Kolb Road and activities at the car wash when the automatic car wash was not operation (vacuum mechanical room and vacuums).

With the automatic car wash operating, the noise levels increased to 65 to 68 dBA at a position 25-feet from the entrance.



Conveyor at Quick N Clean Car Wash

Conveyor at Quick N Clean Car Wash

6.3 Prediction Locations

Noise from the automatic car wash were predicted at the residences south and east of the Dynamite Car Wash, shown in Figure 1.

Location A On the property of the closest residence to the east, on the residence side of the barrier. Approximately 25 feet east of the automatic car wash

entrance.

Location B On the property of the closest residence to the south, residence side of the barrier. Approximately 55 feet south of the automatic car wash entrance.

6.4 Assumptions Used in Predicting Project Generated Noise Levels

The noise prediction included the following assumptions:

- 80% humidity and 80°F were assumed. The noise level at the receivers will be slightly lower, if the humidity is lower or if the temperature is higher.

- Noise reduction from the 7' high wall was considered.

6.5 Prediction Results

The predicted L_{eq} noise levels at the nearest residence to the south and east are shown in Table 2.

Table 2
Predicted L_{eq} Noise Levels and Existing Noise Levels at the Closest Residence to the South and East

Location	Activity	Predicted L_{eq} Noise Levels (dBA)	Existing Measured L_{eq} Noise Levels (dBA)
A	Traffic on 12th and Drexel	51	56-60
	Washing in the manual bays	52	57-61
	Washing in the automatic bay, with conveyor[1]	55	59-65
	Noise from conveyor alone	30	NA
B	Traffic on 12th and Drexel	50	55-59
	Washing in the manual bays	53	58-62
	Washing in the automatic bay, with conveyor[1]	56	60-66
	Noise from conveyor alone	34	NA

1 does not include dryers

As shown in Table 2, the predicted noise levels from the conveyor alone are below the background noise levels at the closest residences. In addition, the predicted noise levels from the conveyor are well below the Tucson City Code noise limits.

Based on the predictions, the inclusion of a conveyor will not increase the overall noise level from the car wash.

7.0 Acoustic Terminology

Sound Pressure Level

Sound, or noise, is the term given to variations in air pressure that are capable of being detected by the human ear. Small fluctuations in atmospheric pressure (sound pressure) constitute the physical property measured with a sound pressure level meter. Because the human ear can detect variations in atmospheric pressure over such a large range of magnitudes, sound pressure is expressed on a logarithmic scale in units called decibels (dB). Noise is defined as “unwanted” sound.

Technically, sound pressure level (SPL) is defined as:

$$SPL = 20 \log (P/P_{ref}) \text{ dB}$$

where P is the sound pressure fluctuation (above or below atmospheric pressure) and P_{ref} is the reference pressure, 20 µPa, which is approximately the lowest sound pressure that can be detected by the human ear.

The sound pressure level that results from a combination of noise sources is not the arithmetic sum of the individual sound sources, but rather the logarithmic sum. For example, two sound levels of 50 dB produce a combined sound level of 53 dB, not 100 dB. Two sound levels of 40 and 50 dB produce a combined level of 50.4 dB.

Human sensitivity to changes in sound pressure level is highly individualized. Sensitivity to sound depends on frequency content, background noise, time of occurrence, duration, and psychological factors such as emotions and expectations. However, in general, a change of 1 or 2 dB in the level of sound is difficult for most people to detect. A 3 dB change is commonly taken as the smallest perceptible change and a 6 dB change corresponds to a noticeable change in loudness. A 10 dB increase or decrease in sound level corresponds to an approximate doubling or halving of loudness, respectively.

A-Weighted Sound Level

Studies have shown conclusively that at equal sound pressure levels, people are generally more sensitive to certain higher frequency sounds (such as made by speech, horns, and whistles) than most lower frequency sounds (such as made by motors and engines) at the same level. To address this preferential response to frequency, the A-weighted scale was developed. The A-weighted scale adjusts the sound level in each frequency band in much the same manner that the human auditory system does. Thus the A-weighted sound level (read as "dBA") becomes a single number that defines the level of a sound and has some correlation with the sensitivity of the human ear to that sound. Different sounds with the same A-weighted sound level are perceived as being equally loud. The A-weighted noise level is commonly used today in environmental noise analysis and in noise regulations. Typical values of the A-weighted sound level of various noise sources are shown in Table 3.

Equivalent Sound Level

The Equivalent Sound Level (L_{eq}) is a type of average which represents the steady level that, integrated over a time period, would produce the same energy as the actual signal. The actual *instantaneous* noise levels typically fluctuate above and below the measured L_{eq} during the measurement period. The A-weighted L_{eq} is a common index for measuring environmental noise.

Table 3
Common Sound Levels in dBA

Common Outdoor Sounds	Sound Pressure Level (dBA)	Common Indoor Sounds	Subjective Evaluation
Auto horn at 10’ Jackhammer at 50’	**100**	Newspaper press Textile mill	Deafening
Gas lawn mower at 4’ Pneumatic drill at 50’	**90**	Auditorium during applause Food blender at 3’	Very Loud
Concrete mixer at 50’ Jet flyover at 5000’	**80**	Telephone ringing at 8’ Vacuum cleaner at 5’	
Large dog barking at 50’ Large transformer at 50’	**70**	Electric shaver at 1’ Clothes washer at 2'	Loud
Automobile at 55 mph at 150’ Urban residential	**60**	Normal conversation at 3’ Window air conditioning unit	
Birds at 25' Small town residence	**50**	Office noise Conference room background	 Moderate
Wind in trees (5 mph) Farm valley	**40**	Soft stereo music in residence Library	
 Rustling leaves	**30**	Average bedroom at night Soft whisper at 3’	Faint
Quiet rural nighttime	**20**	Broadcast and recording studio	
	10	Human breathing	Very Faint
	0	Threshold of hearing (audibility)	

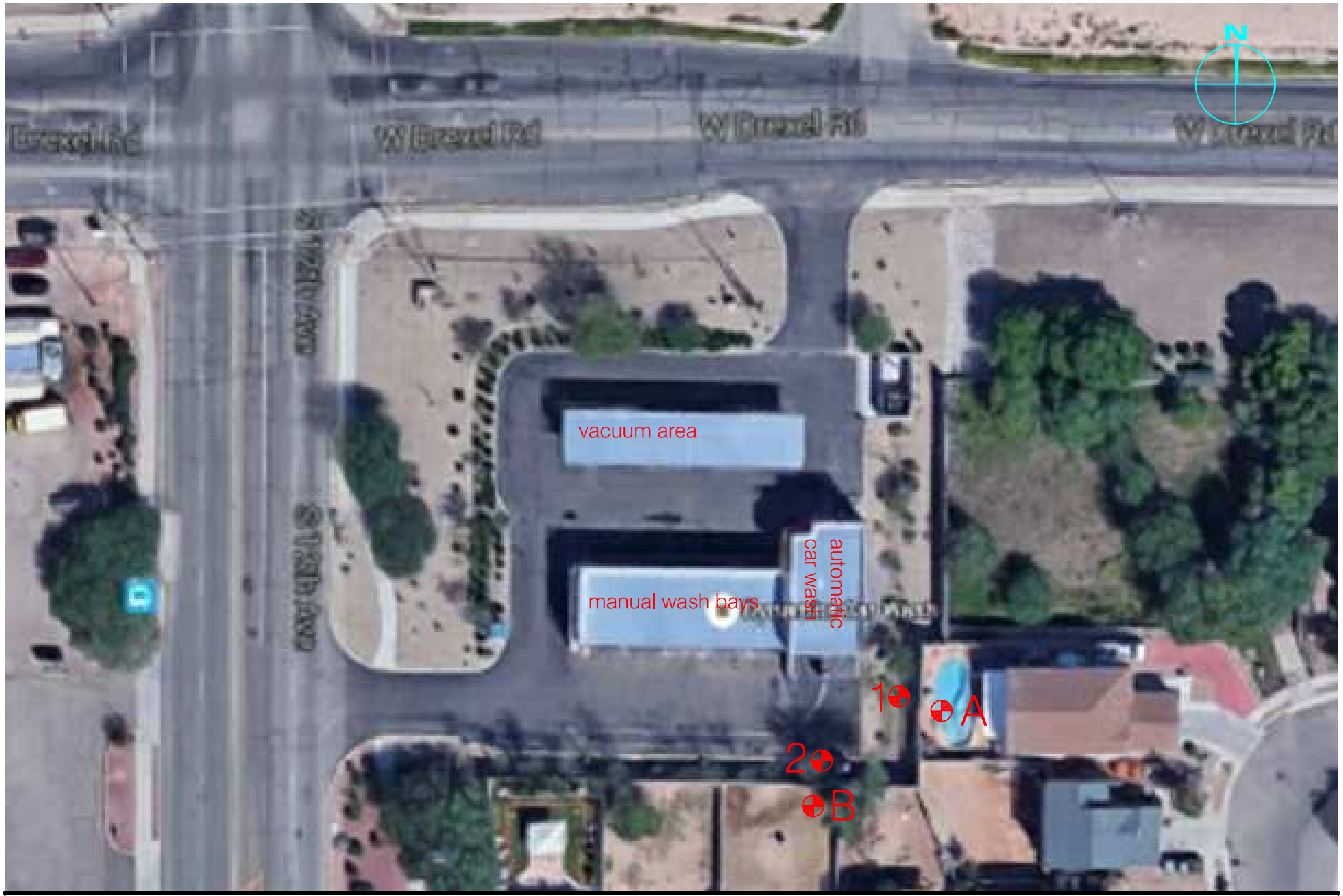


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Figure No. 1

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Dynamite Car Wash
Tucson, Arizona

DESCRIPTION: Noise Measurement Loc

SCALE: 1"=50'